Harris County Public Health
Building a Healthy Community

Air and Health Vulnerability Assessment Methodology

The air and health vulnerability assessment index combined exposure, sensitivity, and adaptive variables to create a single index representative of the overall air quality risk faced by Harris County communities. The exposure, sensitivity and adaptive components of the index were weighted equally, as was each variable within its component. Exposure includes the degree to which the stressor is present in the community. In this assessment, exposure contained two variables, average ozone concentration and average PM2.5 concentration from 2012-2019. The sensitivity index represents the degree to which a community is likely to suffer adverse effects from a given level of exposure and included 11 demographic and health related variables. The adaptive capacity index included 3 variables and represents the degree to which a community is able to mitigate the adverse effects of exposure. All variables underwent min-max normalization (below) that produced a standardized value between 0 and 1 in order to remove units and improve comparisons between data types.

$$Normalized\ Rank = \frac{Value - Minimum}{Maximum - Minimum}$$

Each component index was created by summing the normalized ranks for all variables contained within it, dividing by the number of variables present and conducting min-max normalization on the resulting raw score. One census tract, 48201980000 had only 3 individuals that resulted in a number of extreme values and was removed from the analysis entirely to avoid biasing the results. Two census tracts, 48201312100 and 48201412100 were missing data for one sensitivity variable each. These census tracts were limited to Rice University and the University of Houston campuses and as such were likely not represented by the surrounding neighborhoods making the use of substitute values problematic. The component sum was divided by the number of variables present to control for the missing data. The normalized rank for distance to nearest electric vehicle charging stations was inverted by subtracting the original normalized rank from one as an additional step before being included in the overall adaptive capacity index. This was to keep all three adaptive capacity variables on the same scale where a larger score indicated greater adaptive capacity.

$$Vulnerability\ Index\ (VI) = Exposure + Sensitivity - Adaptive\ Capacity$$

The VI itself is the normalized raw score was that was calculated using the formula above, sum of the exposure index and sensitivity index minus the adaptive capacity index.